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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,096	11/18/2003	Michal Danek	761C4/CPI/L/B/PJS	4854

7590 09/21/2005

Patent Counsel  
Applied Materials, Inc.  
3050 Bowers Avenue  
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EXAMINER
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LUND, JEFFRIE ROBERT

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 09/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/716,096

Applicant(s)

DANEK ET AL.

Examiner

Jeffrie R. Lund

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 June 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Response to Amendment*

1. In response to the arguments presented in the Appeal Brief filed June 30, 2005, the finality of the Office Action mailed March 4, 2005 is withdrawn.

### *Double Patenting*

2. The terminal disclaimer filed on May 4, 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of has been reviewed and is NOT accepted.

- a. The person who signed the terminal disclaimer is not recognized as an officer of the assignee, and he/she has not been established as being authorized to act on behalf of the assignee. See MPEP § 324.

An attorney or agent, not of record, is not authorized to sign a terminal disclaimer in the capacity as an attorney or agent acting in a representative capacity as provided by 37 CFR 1.34 (a). See 37 CFR 1.321(b) and/or (c).

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1-22 rejected under the judicially created doctrine of obviousness-type

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double patenting as being unpatentable over claims 1-15 of U.S. Patent No. 6,155,198 ('198). Although the conflicting claims are not identical, they are not patentably distinct from each other because the claimed structure of the present invention is the same as the structure taught by the claims in '198, and differ only in the wording in which the structure is claimed.

5. Claims 23 and 24 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-15 of U.S. Patent No. 6,155,198 ('198) in view of Davies et al, US Patent 4,313,783.

'198 differs from the present invention in that '198 does not teach a control unit coupled to at least the process chamber.

Davies et al teaches a processing apparatus that includes a computer 46 which is programmed in accordance with how the wafers are to be processed and is coupled to the processing chamber (Figure 1, column 2 line 66 through column 3 line 20)

The motivation for adding the controller of Davies et al to the apparatus of '198 is to provide a required but not disclosed controller that will enable the control and operation of the processing apparatus of '198.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the controller of Davies et al to the apparatus of '198.

### ***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 11 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being

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indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11 recites the limitation "the gas source" in line 1. There is insufficient antecedent basis for this limitation in the claim. It is not clear if the term "the gas source" refers to the "metallo-organic precursor gas source" or the "plasma annealing gas source".

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1, 3, 4, 10, 13-15, and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by Tomoyasu et al, US Patent 5,900,103.

Tomoyasu et al teaches, in the seventh embodiment, a plasma deposition apparatus that includes: a process chamber 710; a shower head 730; a metallo-organic precursor i.e. tetrakis(dimethylamido) titanium gas source 734 for a titanium nitride film; a plasma annealing gas source 776; a wafer support 712; a heater 716 to heat the wafer to about 300°C, i.e. about 350°C; a RF source 728 coupled to the wafer support 712 and to the showerhead 730 (via the ground); and a process controller 758. (Figure 35, column 16 line 42 through column 19 line 34)

***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1-8, 10-16, and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pang et al, US Patent 5,017,403, in view of Sandhu, US Patent 5,576,071.

Pang et al teaches a plasma CVD processing apparatus for depositing a layer on a semiconductor wafer that includes: a process chamber 10; a shower head 29; a gas source 22 that includes nitrogen gas, hydrogen gas, and precursor gas sources; a wafer support 18; a heater 26; a first RF source 14 coupled to the showerhead; and a second RF source 15 coupled to the wafer support. Pang et al also teaches depositing a layer and annealing the layer using a nitrogen or hydrogen plasma in the same chamber.  
(Entire document)

Pang et al differs from the present invention in that Pang et al does not teach depositing a silicon nitride layer using TDMAT and a nitrogen source, a nitrogen and hydrogen plasma having a ration of between about 3:1 to about 1:2, heating the wafer to about 350°C to about 450°C.

Sandhu teaches a SiN deposition method that includes reacting tetrakis(dimethylamido) titanium and N<sub>2</sub> to form a TiN layer (column 3 lines 55-66) at a temperature of 420°C and then treating the TiN layer by exposing it to a nitrogen and

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hydrogen plasma with a ratio of about 1:2 (plasma anneal) to remove carbon (column 4 lines 9-60).

The motivation for using the method of depositing a TiN layer in the apparatus of Pang et al is to enable the apparatus to deposit a TiN layer as taught by Sandhu.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made use the apparatus of Pang et al to deposit a TiN layer as taught by Sandhu.

12. Claims 9 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pang et al and Sandhu as applied to claims 1-8, 10-16, and 18-22 above, and further in view of Tomoyasu et al, US Patent 5,900,103.

Pang et al and Sandhu differs from the present invention in that they do not teach supplying the RF energy 180° out of phase.

Tomoyasu et al was discussed above and includes a phase controller for controlling the phase difference of the RF energy and specifically teaches supplying the RF energy 180° out of phase (Column 9 lines 5-12) to control the energy of the plasma.

The motivation for adding a phase controller to the apparatus of Pang et al and Sandhu as taught by Tomoyasu et al is to control the phase of the energy supplied to the support in order to control the energy supplied to the plasma as taught by Tomoyasu et al.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the phase controller of Tomoyasu et al to the apparatus of Pang et al to control the phase shift between the showerhead and wafer support.

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13. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pang et al and Sandhu as applied to claims 1-8, 10-16, and 18-22 above, and further in view of Davies et al, US Patent 4,313,783.

Pang et al and Sandhu differ from the present invention in that they do not teach a control unit coupled to at least the process chamber, the control unit containing instructions which, when executed, cause the apparatus to form a metal nitride film from the deposition gas mixture (metallo-organic gas, specifically TDMAT, and N<sub>2</sub>) within the process chamber and to plasma anneal the metal nitride film using the annealing gas within the process chamber.

Davies et al teaches a processing apparatus that includes a computer 46 which is programmed in accordance with how the wafers are to be processed and is coupled to the processing chamber (Figure 1, column 2 line 66 through column 3 line 20)

The motivation for adding the controller of Davies et al is to the apparatus of Pang et al and Sandhu is to provide the apparatus of Pang et al with a required control system, and enable the apparatus of Pang et al to perform the process of Sandhu.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the controller of Davies et al to the apparatus Pang et al and Sandhu.

14. Claims 1-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakamoto et al, US Patent 5,698,062, in view of Sandhu, US Patent 5,576,071.

Sakamoto et al teaches a plasma processing apparatus that includes: a process chamber 2; a shower head 21; a gas source 30; a wafer support 5; a heater; a first RF



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source 51 coupled to the showerhead; and a second RF source 41 coupled to the shower head and wafer support. Sakamoto et al also teaches that the power supplied to the wafer support is phase shifted 180°. (Entire document)

Sakamoto et al differs from the present invention in that Sakamoto et al does not teach nitrogen, hydrogen, or TDMAT gas sources, or depositing a silicon nitride layer using TDMAT and a nitrogen source, a nitrogen and hydrogen plasma having a ration of between about 3:1 to about 1:2, heating the wafer to about 350°C to about 450°C.

Sandhu teaches a SiN deposition method that includes reacting tetrakis(dimethylamido) titanium and N<sub>2</sub> to form a TiN layer (column 3 lines 55-66) at a temperature of 420°C and then treating the TiN layer by exposing it to a nitrogen and hydrogen plasma with a ratio of about 1:2 (plasma anneal) to remove carbon (column 4 lines 9-60).

The motivation for adding nitrogen, hydrogen and TDMAT gas sources and using the method of depositing a TiN layer in the apparatus of Sakamoto et al is to enable the apparatus of Sakamoto et al to deposit a TiN layer as taught by Sandhu.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made add nitrogen, hydrogen, and TDMAT sources to the apparatus of Sakamoto et al and to use the apparatus of Sakamoto et al to deposit a TiN layer as taught by Sandhu.

15. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakamoto et al and Sandhu as applied to claims 1-22 above, and further in view of Davies et al, US Patent 4,313,783.

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Sakamoto et al and Sandhu differ from the present invention in that they do not teach a control unit coupled to at least the process chamber, the control unit containing instructions which, when executed, cause the apparatus to form a metal nitride film from the deposition gas mixture (metallo-organic gas, specifically TDMAT, and N<sub>2</sub>) within the process chamber and to plasma anneal the metal nitride film using the annealing gas within the process chamber.

Davies et al teaches a processing apparatus that includes a computer 46 which is programmed in accordance with how the wafers are to be processed and is coupled to the processing chamber (Figure 1, column 2 line 66 through column 3 line 20)

The motivation for adding the controller of Davies et al is to the apparatus of Sakamoto et al and Sandhu is to provide the apparatus of Sakamoto et al with a required control system, and enable the apparatus of Sakamoto et al to perform the process of Sandhu.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the controller of Davies et al to the apparatus Sakamoto et al and Sandhu.

16. Claims 1-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomoyasu et al, US Patent 5,900,103, in view of Sandhu, US Patent 5,576,071.

Tomoyasu et al teaches, in the first embodiment, a plasma processing apparatus that includes: a process chamber 2; a shower head 21; a gas sources 35-37 (including nitrogen); a wafer support 5; a heater; a first RF source 61 coupled to the showerhead; and a second RF source 51 coupled to the wafer support. (Entire document)

Tomoyasu et al differs from the present invention in that Tomoyasu et al does not teach a hydrogen or TDMAT sources, or depositing a silicon nitride layer using TDMAT and a nitrogen source, a nitrogen and hydrogen plasma having a ration of between about 3:1 to about 1:2, heating the wafer to about 350°C to about 450°C.

Sandhu teaches a SiN deposition method that includes reacting tetrakis(dimethylamido) titanium and N<sub>2</sub> to form a TiN layer (column 3 lines 55-66) at a temperature of 420°C and then treating the TiN layer by exposing it to a nitrogen and hydrogen plasma with a ratio of about 1:2 (plasma anneal) to remove carbon (column 4 lines 9-60).

The motivation for using the method of depositing a TiN layer in the apparatus of Tomoyasu et al is to enable the apparatus to deposit a TiN layer as taught by Sandhu.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made use the apparatus of Tomoyasu et al to deposit a TiN layer as taught by Sandhu.

17. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomoyasu et al and Sandhu as applied to claims 1-22 above, and further in view of Davies et al, US Patent 4,313,783.

Tomoyasu et al and Sandhu differ from the present invention in that they do not teach a control unit coupled to at least the process chamber, the control unit containing instructions which, when executed, cause the apparatus to form a metal nitride film from the deposition gas mixture (metallo-organic gas, specifically TDMAT, and N<sub>2</sub>) within the process chamber and to plasma anneal the metal nitride film using the annealing gas

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within the process chamber.

Davies et al teaches a processing apparatus that includes a computer 46 which is programmed in accordance with how the wafers are to be processed and is coupled to the processing chamber (Figure 1, column 2 line 66 through column 3 line 20)

The motivation for adding the controller of Davies et al is to the apparatus of Tomoyasu et al and Sandhu is to provide the apparatus of Tomoyasu et al with a required control system, and enable the apparatus of Tomoyasu et al to perform the process of Sandhu.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the controller of Davies et al to the apparatus Tomoyasu et al and Sandhu.

### ***Response to Arguments***

18. Applicant's arguments with respect to claims 1-24 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

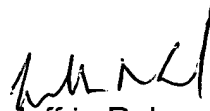
19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The cited art teaches the technological background of the invention. This art also includes references that teach TiN deposition using TDMAT, plasma annealing, and programmable controllers that could be used in rejections.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrie R. Lund whose telephone number is (571) 272-1437. The examiner can normally be reached on Monday-Thursday (6:30 am-6:00pm).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Jeffrie R. Lund  
Primary Examiner  
Art Unit 1763

JRL  
9/16/05